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Historical Aspects of the IGY

Marcel Nicolet
Secretary General
Special Committee for the International Geophysical Year

Editor's Note: During the week of September 25–October 3, 1982, an exhibition was organized at the Academy Palace in Brussels as Belgium's celebration of the 100th anniversary of the First Polar Year, the 50th anniversary of the Second Polar Year, and the 25th anniversary of the International Geophysical Year. It was dedicated to past and present geophysical activities in order to show the promises of future work. Five organizations took part in the exhibition: the Aeronomy Institute, the Antarctic Research Committee, the National Geographic Institute, the Meteorological Institute, and the Royal Observatory. King Baudouin gave his sponsorship and visited the exhibition.

The following article is based on a speech delivered by Marcel Nicolet at the inauguration ceremony on September 25. The speech, entitled 'Les tenants et les aboutissants de l'Année Géophysique Internationale,' was translated by C. M. Minnis, URSI Secretary General Emeritus.

Geophysics is a branch of science which has successfully integrated many different areas of research into a coherent whole. It represents the synthesis of various broad fields of knowledge relating to both the past and the present, and this provides a basis for speculating about the future. Since geophysical research must be pursued over the whole of our planet, into the most distant continents, and even across Antarctica, it calls for the application of all man's resources. It reconstructs the past through a process of reappraisal, reflection, and discussion; it elucidates the present and thereby leads us not only to image, to measure, and to study distant events, but also to understand better the mysteries of nature. Indeed, knowledge is the key which geophysics uses to open doors leading toward the future. Geophysics must also be accepted as a branch of fundamental research in which concerted action is an essential feature; it remains in contact with society by combining research and development and assesses the value of the knowledge acquired in terms of the contribution it makes to the welfare of mankind.

In the history of science, the First International Polar Year (1882–1883) was the first major event in which the fundamental concept was multidisciplinary cooperation on an international scale. Weyprecht, who conceived the idea of such a project, was obliged over a period of several years to defend his proposals and to promote them. It was not until a year after his death, and in spite of the outbreak of the war in the Balkans, that a small group of geophysicists of the period launched this first great peaceful enterprise.

In the wake of the heroic epoch of the First Polar Year, there followed many important developments in scientific instrumentation, and great improvements in communications within and between the continents. It was in 1927 that J. Giorgi, a meteorologist, made the suggestion that the 50th anniversary of the First Polar Year should be celebrated in 1932. This led to the creation of a Special Commission which was made responsible for the Second Polar Year (1932–1933); its President was D. laCour, Director of the Meteorological Service in Denmark. The preparations for the event were confronted with many difficulties arising out of the world economic crisis of the 1930s; indeed on several occasions doubts were expressed about whether it was wise to continue, but finally these were overcome by the tenacity and the persuasive powers of laCour.

In the end, in spite of the practical problems encountered, the program for the Second Polar Year was carried out. Unfortunately, the outbreak of World War II in 1939 resulted in the suspension of normal international scientific relations. After the end of the war, in 1946, the Conference of Directors of the International Meteorological Organization, at its meeting in London, decided to dissolve all its Commissions. However, at its meeting in Paris in July 1946, the International Meteorological Committee created the Polar Year Liquidating Commission; this body was made responsible for continuing the analysis of the data, which had already begun before the War, and for completing the task by December 1950.

In this connection it is important to recall that the President of the Liquidating Commission was John Fleming, President of the International Association of Terrestrial Magnetism and Electricity from 1934 to 1948, and also Director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. Thanks to his worldwide reputation, Fleming was able to stimulate geophysicists into thinking about what future actions should be taken so as to give a fresh impetus to their branch of science. The range of new techniques already available, including the first rockets carrying scientific instruments, led them to give high priority to making observations in the third dimension. The need to think in terms of a new commitment of some kind was further strengthened by the approaching target date for the completion of the study of the data acquired during the Second Polar Year: December 1950.

It was in this atmosphere that, in January 1950, I visited the Department of Terrestrial Magnetism and the National Bureau of Standards in Washington, D.C. before spending 6 months in California. Just afterward, in fact on April 5, 1950, Lloyd Berkner made the *first suggestion about the possibility of organizing a series of polar years separated by intervals of 25 years.* At a meeting of about 20 scientists (Bates, Berkner, Chapman, Elvey, Kaplan, Nicolet, Roach, Tuve, Van Allen, . . .) in May 1950, held at Inyokern, China Lake, in the California desert, there was some discussion about various aspects of *research in the upper atmosphere, during* which ideas put forward by several participants were borne in mind.

These ideas were raised again in July 1950 at a meeting of about 200 scientists who participated in a 'Conference on the Physics of the Ionosphere,' convened by A. H. Waynick of the Ionosphere Research Laboratory of *Pennsylvania State University.* On this occasion, some of those ready to go to Brussels were in favor of officially submitting the idea of a new 'international polar year' to the Mixed Commission on the Ionosphere, which was due to meet in this 'Palace of the Academies' September 4–6, 1950. Thus Brussels became the focal point, 25 years ago, for the project which came to be known as the International Geophysical Year, 1957–1958.

The Mixed Commission (E. V. (later Sir Edward) Appleton as Chairman and a membership of Aono, Berkner, Beynon, Booker, Burrows, Maeda, Hagihara, Hamada, Herbays, Kotani, Lejay, Martyn, Massey, Menzel, Nicolet, Shapley, and Waynick) forwarded its proposals to the scientific unions represented in it. These were approved by all the unions, including the IUGG, which held its General Assembly in Brussels in 1951 at the invitation of the Belgian National Committee for Geodesy and Geophysics. In May 1952 the International Council of Scientific Unions (ICSU) formed the Special Committee for the International Geophysical Year, usually known under the initials of its French title: CSAGI. The members designated to represent the unions were: Berkner and Beynon (URSI), Coulomb and Laursen (IUGG), Norlund and Nicolet (IAU), and Wordie (IGU). Van Mieghem was later enlisted to represent the World Meteorological Organization.

The first official meeting of CSAGI was attended by the three senior representatives, Berkner, Coulomb, and Nicolet, and took place in Brussels on October 13, 1952. Through our Secretary, E. Herbays, we appealed to the national academies of sciences adhering to ICSU, as well as to the interested unions and the World Meteorological Organization (WMO), for their collaboration. At the same time, a request for financial support was made to the United Nations Educational, Scientific, and Cultural Organization (UNESCO).

The CSAGI met in this Palace from June 30 to July 3, 1953, at the invitation of our Academies, and by this time 30 national academies had already agreed to support the concept of the International *Geophysical Year.* Before the IGY began, general assemblies were convened in 1954, 1955, and 1956 in Rome, Brussels, and Barcelona respectively; the final Assembly was held in Moscow in July 1958.

The membership of CSAGI was made up of the representatives of the scientific unions, *with the participation of the WMO.* From its inception, the Committee had the responsibility for developing a practicable program of observations covering the various disciplines of geophysics. The diversity of the topics incorporated in the final program soon resulted in the inclusion of about 30 members in the Committee.

Accommodation for the General Secretariat of CSAGI was provided at Uccle, near Brussels, by the Radiation Service of the Royal Meteorological Institute in Belgium. The central direction of the program was entrusted to a bureau, whose members were: S. Chapman, President (U.K.); L. Berkner, Vice-President (U.S.); M. Nicolet, Secretary General (Belgium); J. Coulomb, Member (France); and V. Beloussov, Member (USSR).

In addition to the bureau, there were 14 discipline reporters, each of whom was responsible for one of the scientific disciplines. They are listed in Table 1, and their names and interests give some idea of the scope of the program as a whole. Finally, the CSAGI included several assistant scientific secretaries who were given the task of organizing a number of international conferences, each designed to deal with questions of particular interest to a geographical region.

For each of the disciplines, the program was first elaborated by a committee created under the auspices of one or more of the unions and scientific associations adhering to ICSU. After this preliminary stage, the IGY program as a whole was studied by the bureau and by CSAGI, and was finally coordinated during the general assemblies, at which all the participating academies were represented, and also during the regional conferences mentioned earlier. Other conferences were held to discuss questions concerning related groups of disciplines. One of these, held in Washington, D. C. from September 30 to October 5, 1957, dealt with the problems of rockets and satellites and coincided with the launch of Sputnik 1, the first artificial earth satellite, on October 4.

It would not be possible here to review all the preparatory work carried out within each discipline. Briefly, each Reporter carried the responsibility for editing an Instruction Man-

TABLE 1. The Discipline Reporters of CSAGI

Activity	Reporters
World Days	A. H. Shapley (U.S.)
Meteorology	J. Van Mieghem (Belgium)
Geomagnetism	V. Laursen (Denmark)
Aurora and Airglow	S. Chapman (U.K.) (with F. Roach and C. Elvey, both U.S.)
Ionosphere	W. J. O. Beynon (U.K.)
Solar Activity	Y. Ohman (Sweden)
Cosmic Rays	J. A. Simpson (U.S.)
Longitudes and Latitudes	A. Danjon (France)
Glaciology	J. M. Wordie (U.K.)
Oceanography	G. Laclavère (France)
Rockets and Satellites	L. V. Berkner (U.S.)
Seismology	V. V. Beloussov (USSR)
Gravimetry	P. Lejay (France)
Nuclear Radiation	M. Nicolet (Belgium)

Marcel Nicolet received his Ph.D. in astrophysics at Liège University in 1937. Since 1951 he has been associated with the Ionosphere Research Laboratory of the Pennsylvania State University, where he is an adjunct professor of aeronomy. From 1953 to 1960 he was Secretary-General of the IGY. In 1960 he was director of Belgium's National Space Research Center and in 1965 became first director of the Belgian Aeronomy Institute. He was president of the International Association of Geomagnetism and Aeronomy from 1963 to 1967. A retired professor of external geophysics at Brussels University and of space physics at Liège University, he has more than 200 publications in the fields of astrophysics, aeronomy, and meteorology and is a member or foreign associate of numerous professional societies and academies.

Editorial

Are You Listening?

After two and one-half years of knocking at your door, AGU-GIFT cannot be a stranger. The acronym, GIFT = GIrding For Tomorrow, should be familiar to all members of AGU. The number of members who have recognized GIFT with their contributions is increasing each year, yet we can hardly say that 'the feast is ready.'

At the time that the AGU headquarters building was purchased in 1980, it was known that there would be a mortgage of $1 million-plus on which no major prepayment could be made prior to 1986. Some of us heard opportunity knocking. Could we respond? We knew that the membership of AGU includes a large number of retirees who are living comfortably within an upper-tax-bracket income plus many more members, still active, who prosper because of their careers in geophysics. We believed that AGU has contributed as much to this prosperity as any federal agency, university, or research institution. Why, then, should we not reinvest some of our dividends in the future of AGU?

We compiled a list of Senior Members—former officers, Medalists, committee chairmen—men and women who represented the professional heart of AGU. One of our major tasks was to challenge these members to respond to the initial knock at the door or every member-solicitation by direct mail so that the example of their leadership would encourage others to contribute. We had visions of 50 or more members willing to respond with pledges or gifts of $1,000 per year for 5 years. *A few shares of stock that have* doubled in value since last August would do the same thing. The question now to these senior members is—*Have you really been listening?*

Many listened and accepted the challenge. The number of Individual Supporting Members (ISMs) has been increasing steadily. In 1980 the number was less than 20—now the number is close to 150. These are the members who contribute at least $80 annually beyond their regular dues payment. They are demonstrating their support of AGU by a significant aspect of unselfish cooperation. Is it unreasonable to believe that a majority of the Fellows of AGU should be ISMs? The number of Fellows is close to four hundred, yet less than 15% of the Fellows are ISMs.

Those of us on the Steering Committee for AGU-GIFT—the dozen or so members who serve as the fund raisers for AGU—believe that *Eos* should be the messenger to carry the good news and the knock at your door. By using *Eos*, we eliminate a major cost—direct mailing. Also, the Steering Committee supports the use of the dues invoice to offer an opportunity for a voluntary contribution. Almost 3600 members accepted the opportunity offered by the 1982 dues invoice (mailed August 1981). For the 1983 dues invoice (mailed August 1982) the number is 3877, an 8% increase over the first year. There are always a few conscientious objectors to this procedure but they have not seriously offered any other method.

If you believe that you have listened well to the sound of opportunity knocking, look at the latest tabulation of the total giving by Sections. You must be encouraged by the percentage of participation but, more important, you should have some concern about the *average per contributor.* Surely AGU merits greater support.

We wish to assure you that the members of the Steering Committee retain their good natures. Moreover, we do sincerely appreciate the cooperation of all those who have been supporting the AGU-GIFT Program so generously. We have written our warmest thanks to these contributors and told them how much their continuing support benefits the Union. However, we are concerned. For the full membership, we go forward together and repeat our refrain: *Are you listening?*

Earl G. Droessler
Charles A. Whitten
Cochairmen
AGU-GIFT Steering Committee

AGU-GIFT Contributions as of April 18, 1983

Section	Number of Contributors	Percent of Members	Cash Received	Average per Contributor	Unpaid Pledges	Total Contribution
Atmospheric Sciences	419	41	$14,849	$35	$ 530	$15,379
Geodesy	218	39	14,545	67	5,765	20,310
Geomagnetism and Paleomagnetism	321	45	10,710	33	980	11,690
Hydrology	877	35	17,329	20	1,424	18,753
Oceanography	653	33	13,183	20	1,827	15,010
Planetology	252	36	6,072	24	400	6,472
Seismology	583	40	11,845	20	380	12,225
Solar/Planetary Relationships	710	42	13,606	19	140	13,746
Tectonophysics	506	37	14,206	28	2,805	17,011
Volcanology, Geochemistry, Petrology	508	34	11,111	22	300	14,411
No section	354	30	4,645	13		4,645
Friends			2,100			2,100
Commercial institutions	1		2,500			2,500
Designated for Merle Tuve Memorial—$3,150						
Total	5,401	37	$136,701	$24	$14,551	$151,252

The CSAGI Bureau, IGY's international board of directors, at Uccle, near Brussels, June 1957. Left to right, V. Beloussov of the USSR, L. Berkner of the United States, M. Nicolet of Belgium, J. Coulomb of France, and S. Chapman of the United Kingdom. (Photo by Loomis Dean, *Life* Magazine, ©1957 Time, Inc.)

ual containing sections prepared by experts. About a dozen of these manuals were distributed to the IGY participating committees before the beginning of the observational program, and were published in *Annals of the IGY*. In addition, each of the unions interested in the IGY had already sent out information on the essential elements of the programs with which it was concerned.

Because of limitations on the number of scientists and on the availability of equipment, not to speak of financial restrictions, attention was concentrated on three geographical areas: the Arctic, the Antarctic, and the equatorial belt. These satisfied certain geographic and geomagnetic conditions determined by the requirements of the various disciplines, and took account of the logistical facilities then available. In addition, three other zones were superimposed on those just mentioned; these were defined in terms of geographical meridians and corresponded to the continent of North America, Europe, Africa, and the Far East (or 140°E). Thanks to the decision to concentrate attention on certain geographical regions, it was possible to economize when deciding on the locations of new stations, while at the same time facilitating the acquisition of representative data for most geophysical phenomena.

Some idea of the vast scale of the preparations for the IGY can be gained from the fact that the first 10 volumes of *Annals of the IGY*, which were devoted to this aspect of the program, contain 5,000 pages.

It is worth recalling that, as early as 1953, the IGY Bureau had foreseen the possibility of launching artificial satellites in 1957 or 1958 during the IGY. Indeed, this was borne in mind when the IGY symbol was designed by the IGY Secretariat in 1954; it showed the trajectory of a satellite across a background of lines of latitude and longitude as well as the boundary between night and day, and it emphasized the privileged place given to th Antarctic.

Here today, in the marble hall of this Palace, you will find the exhibition commemorating the 25th Anniversary of the IGY. It was in that same hall, at 6:45 P.M. on July 29, 1955, that the first announcement was made of the future launch of an artificial satellite. As Secretary General of CSAGI, I had that morning received, by special messenger, a letter from the President of the U.S. National IGY Committee. The news of the coming event was publicly announced in Brussels at the local time corresponding to the time of the official announcement made simultaneously in Washington, D. C. and in 40 countries participating in the IGY.

At the beginning of 1956 I invited the IGY Committee in the USSR to consider participating in the program involving rockets and satellites. The invitation received an immediate welcome, but the official announcement of the plans envisaged was not made until the General Assembly of CSAGI in Barcelona in September 1956.

The first use of artificial satellites for scientific research during the IGY was in itself an outstanding event, but it marked also the beginning of an intensive exploration of the terrestrial environment in space, which has since led to the even more remarkable achievements of the present time. The explosion which took place 25 years ago in studies of aeronomy in association with terrestrial magnetism resulted in a profound modification of the basic ideas that had formerly been accepted in investigations of the relations between solar and terrestrial phenomena.

The subject of terrestrial magnetism quickly divided into two different aspects, each corresponding to particular types of experimental and theoretical investigations. The first of these is internal magnetism, which relates to the physics of the earth's interior, while the second, external magnetism, refers to the extremely complex variations caused by changes in the geometry of the lines of magnetic force; these can occur at distances ranging from 10 earth radii down to an altitude of 1000 km. It is for this reason that certain characteristics of the ionosphere and also the modulation of extra-galactic cosmic rays are both closely connected with the variations in the magnetic field that take place at the outer limits of the atmosphere. The simultaneous study of such phenomena during the IGY led naturally to a logical rearrangement of the disciplines, which recognizes the morphological coherence of the various elements now included in 'external geophysics.'

The successful planning and preparation of such a complex operation as the IGY was greatly facilitated by the great flexibility of the organizational structures adopted, and also by the cooperation of the most distinguished representatives of the international scientific unions. In addition, a grant of $100,000 made by UNESCO and the contributions ($200,000) received from the participating committees made it possible to maintain a permanent Secretariat at Uccle during the 6-year period from 1953 to 1959. This Secretariat, without which I could not have fulfilled my responsibilities, consisted at first of Phillip Mange and Delphine Jehoulet, now in the United States; they were joined later by Paulette Doyen, Mike Baker, and Francine and Maurice Hautfenne, who are present today. Sir Archibald Day (Coordinator) and Sir Harold Spencer Jones (Editor of the *Annals of the IGY*) both died several years ago.

As for the results achieved during the IGY, it would be quite impossible to review them here since their description takes up 38 volumes of the *Annals*. The completion of this series of 45 volumes was made possible by the creation of the International Geophysical Committee (CIG) after the dissolution of CSAGI in 1959. This Committee also laid the foundations for a new program of observation: the International Years of the Quiet Sun (IQSY), 1964–1965.

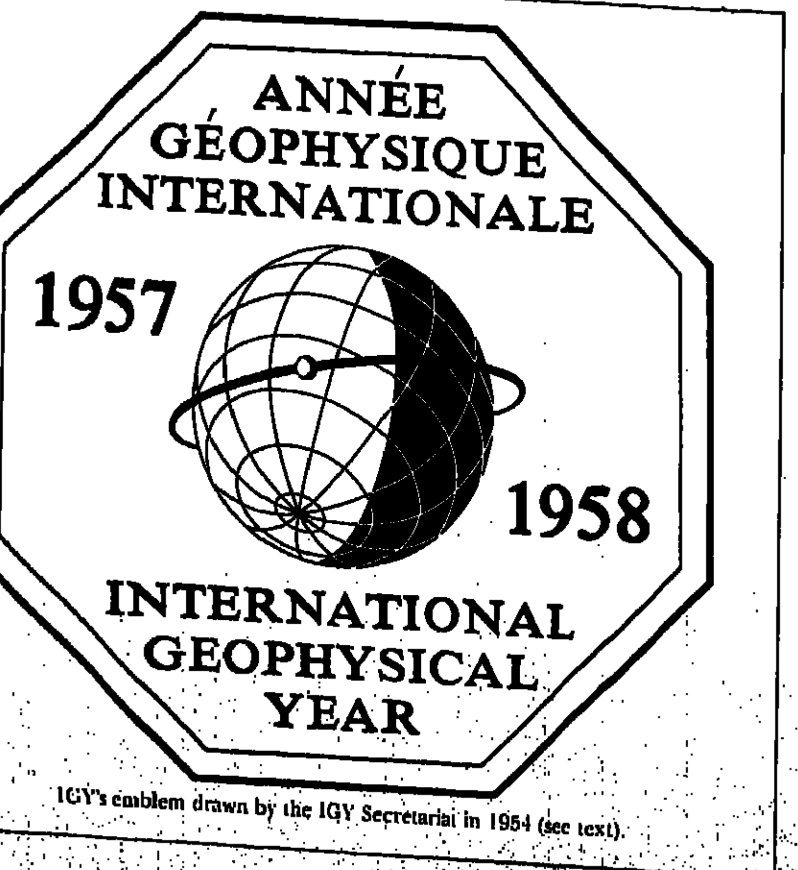
Before concluding, I must refer to the way in which a voluntary organization including representatives of 67 countries succeeded in steering such a complex project to a successful conclusion.

The first important achievement of the IGY was that it attracted the attention of thousands of men and women from all parts of the world who freely and spontaneously devoted their efforts to the attainment of a common scientific objective.

Besides this, the enterprise was able to benefit from the support of governments without itself being a governmental body; in addition it could count on logistical support provided by armed forces without being in any way military in character. Finally, although the IGY was based on international collaboration between scientists in 67 countries, it was able to avoid becoming involved with the rigid framework of established international organizations.

The IGY successfully attained its main objectives, but it would be wrong to conclude that the political conditions of the period were always favorable. I shall not refer here to various events, relating to the international political situation, which often complicated the task of those who were engaged in the direction of the enterprise; these might, perhaps, be a subject for another occasion. Today, I shall simply say that the geophysicists kept their feet on the ground and, although they were sometimes obliged to express disapproval, they never gave way. They kept their eyes firmly fixed on the ultimate objectives, and their will to attain these was sufficiently strong to enable them to surmount the natural and the artificial barriers that they encountered.

In the final analysis, the IGY can be regarded as a crucible out of which the science of geophysics emerged with new, permanent characteristics. It served to define certain guidelines, and these have since determined the directions in which modern geophysical research is now progressing. Today, this research is carried out in an atmosphere of international collaboration, the origins of which are unknown to the present generation. Every true geophysicist accepts this collaboration without hesitation and in a spirit of scientific rivalry in the service of mankind.'



IGY's emblem drawn by the IGY Secretariat in 1954 (see text).

Forum

NASA and SEEP

In the recent news note by R. F. Harth entitled 'Detecting Electron Precipitation' (*Eos*, March 22, 1983, p. 114), it is stated that NASA performed an experiment 'similar' to the Navy's Stimulated Emission of Energetic Particles (SEEP) satellite program using sounding rocket X ray detectors. The NASA effort was actually a cooperative part of the SEEP program that was, with the exception of the two small NASA rockets, sponsored entirely by the Office of Naval Research. The SEEP program originated at Lockheed Palo Alto Research Laboratory and Stanford University and was well along before Dr Goldberg at Goddard Space Flight Center and his coinvestigators at Cornell and the University of Denver were invited to participate.

Even the rocket launches were coordinated with the Navy and Lockheed personnel, so that the NASA project was always dependent upon the Navy's SEEP program. We at NASA are pleased that SEEP was successful, and are proud to have been part of that overall success; however, the credit for the conception and execution of SEEP should go to the Navy and the researchers whom they sponsored at LPARL and Stanford.'

John T. Lynch
Earth Science and Applications
National Aeronautics and Space Administration
Washington, DC 20546

Giving Through Life Insurance

Your Union's Gift Steering Committee has pointed out from time to time various methods of contributing to the Union that may provide certain members with the satisfaction of recognizing the value and attainments of the organization, and the part it played in the individual's career, combined with a maximum of convenience as well as tax and other advantages. One such method is to make the Union a beneficiary of one or more life insurance policies.

The committee recently learned of an example of such giving that seems so pertinent to the committee's thinking that it is here called to the attention of the membership. The example is a gift to The George Washington University (GW) and was discussed in some detail on page 3 of the November 1982 *GW Times* under the heading 'Getting and Giving: Carol Brosnan's Story.'

'Carol Brosnan entered the university in 1957 while also working full time at the National Science Foundation. In 1960, before she had graduated, she suffered a severe back injury. She had to wear a back brace and was in great pain for nearly 2 years. Her educational plans were apparently wrecked. Nothing daunted, she went back to work as soon as she was able, and in 1977 resumed her educational career part time at the university with much encouragement and help from friends on the faculty. She received a degree in history in 1981 and currently is working toward a master's degree.

'A grateful Carol Brosnan has named several units of the university to benefit substantially from a life insurance policy that may have a value eventually of approximately $75,000.

The article points out that, 'The advantages of making a gift of life insurance to the university are many. The gift is certain, not open to contest, nor subject to probate costs. The proceeds are payable immediately at death in cash, with the beneficiary or beneficiaries receiving all the proceeds.

'Since life insurance is given in small, regular amounts, . . . the donor builds values for the charity over a long period of time. This convenience has made it easier for Brosnan, who lives on a fixed income, to provide her alma mater with a larger-than-average gift.

'A gift of life insurance is a personal, living donation. The donor can be more generous by giving life insurance because the proceeds are paid directly to the charity, thereby saving estate settlement costs . . . . In addition, one's estate is not diminished because life insurance, by its very nature, creates what amounts to an additional, separate estate.'

And finally, 'A life insurance gift is convenient. Numerous alumni and friends may already have on hand policies that have fulfilled their original purposes and could now be considered for charitable purposes. Changing the beneficiary and ownership on a policy is a relatively simple process. And by naming GW as policy owner and beneficiary, the donor can take an income tax charitable contribution deduction on the insurance premiums paid each year.'

To those AGU members whom this particular shoe may fit, try substituting in the paragraph just quoted 'members' for 'alumni' and 'AGU' for 'GW.' It's a good thought

John C. Reed
AGU-GIFT Steering Committee

News

Keyworth Urges Setting Priorities

A strong advocate of scientists setting priorities within their disciplines, George A. Keyworth, II, President Reagan's science advisor and director of the Office of Science and Technology Policy, recently offered three possible consequences if such priorities are not set.

'I'm especially worried about the continued inability—or unwillingness—of the science community to agree among themselves about priorities—or to abide by their decisions when they *can* agree,' he said [emphasis his]. 'I wouldn't think it necessary that I remind them that these are tough times. I'll add that for anyone depending on federal funding, they're going to remain tough times for quite a while,' Keyworth told the American Physical Society at its mid-April meeting in Baltimore, Md.

'There are three choices, none of them good,' Keyworth continued. 'It may be that funding increases will simply be deferred until the community can come to some consensus. Or decisions may be based on such nonscientifically relevant factors as preservation of politically popular facilities. Or disaffected minority viewpoints, when they're the dominant messages transmitted to the decision makers, may well carry the day. I come back to the central point: The community has to be willing to establish its own priorities and then stand by them in the public arena.'—*BTR*

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Cover. A plaque recognizing the major contributors to the AGU GIFT campaign now hangs in the eighth floor lobby near the executive offices at AGU headquarters. This issue includes the first 1983 update on the GIFT fund: the Editorial and Forum pieces by members of the Steering Committee; the list of Individual Supporting Members; and a pledge card on the back cover. If you have not been able to participate in this program to strengthen AGU, use the pledge card to do so now. The following members have contributed $1000 or more and are recognized on the plaque: Philip H. Abelson, L. Thomas Aldrich, Richard J. Anderle, Robert R. Bennett (In Memoriam), Allan V. Cox, Samuel S. Goldich, Pembroke J. Hart, A. Ivan Johnson, Helmut E. Landsberg, Paolo Lanzano, Thomas F. Malone, Murli Manghnani, L. L. Nettleton, Hyman Orlin, Erick Schonstedt, Athelstan Spilhaus, A. F. Spilhaus, Jr., John W. Townsend, Jr., James A. Van Allen, Charles A. Whitten, and J. Tuzo Wilson.

Copyright Suit Partly Settled

Amidst continuing confusion on what constitutes 'fair use' photocopying of copyrighted material, the first legal action taken against an academic institution and individual professors for alleged violations of copyright law has been partly settled. Nine book publishers charged last December that New York University (NYU), several of its faculty, and an off-campus commercial photocopying establishment had violated copyright law. The action against NYU and its faculty was settled out of court. The portion of the lawsuit directed against Unique Copy Center will continue, however.

The suit, coordinated for the nine publishers by the Association of American Publishers (AAP), underscores the need for professors to understand the law concerning photocopying multiple works for classroom use and to understand when they must seek permission from a publisher before photocopying copyrighted material.

As part of the settlement, NYU agreed to enforce through December 31, 1985, classroom guidelines (see box) that were developed in 1976 by educators, authors, and publishers when the new U.S. copyright law was enacted. These guidelines are part of the legislative history of the law and are contained in a committee report of the U.S. House of Representatives. NYU agreed to spell out the policy in its faculty handbook, to investigate allegations of copyright infringement by its faculty, and to discipline faculty members found guilty of such infringement. The university has instructed its faculty to use these classroom guidelines to determine if copyrighted material may be photocopied. NYU also gave its faculty a procedure for determining when there is fair use beyond the guidelines (copyright law may allow for photocopying beyond that which is outlined in the guidelines, which state the minimum standards of the 'fair use' doctrine): If the guidelines do not allow for photocopying, permission must be sought from the publisher. Faculty who have sought permission but feel they have been unreasonably denied it should consult with university counsel. If university counsel is not sought, NYU says it would not defend the faculty member if litigation ensues.

Many university professors view the photocopying of material from journals and books for their students as essential. Often, for many specialized subjects, professors copy journal articles and portions of books to fill the gaps in textbook material; to provide students with the research results from the frontiers of their field; and to ensure that a large class has access to key portions of the literatur

Carol Risher, AAP's copyright director, told *Eos* that AAP recognizes that photocopying to keep students at the frontiers of a particular academic field is a creative teaching method and, as such, is 'not seeking to stop or limit photocopying. We want the copying to continue, but with [the necessary] permission,' she emphasized.

Most of the confusion centers on the interpretation of the 'fair use' doctrine of section 107 of the copyright law (P.L. 94–553), entitled 'limitations on exclusive rights: fair use.' Four tests are applied to determine if a given instance of library photocopying is fair use: the purpose and nature of the use; the nature of the copyrighted work; the amount and substantiality of the portion used in relation to the work as a whole; and the effect of the use upon the potential market for or value of the copyrighted work.

To help eliminate confusion over section 107, the Ad Hoc Committee on Copyright Law Revision, the author-publisher group of the Authors League of America, and AAP established a set of guidelines for classroom copying, which are 'not intended to limit the types of copying permitted under the standards of fair use under judicial decision,' according to the prologue to the guidelines. 'There may be instances in which copying which does not fall within the guidelines stated below may nonetheless be permitted under the criteria of fair use.'

AAP hopes that the suit and settlement will encourage other universities to adopt similar or identical policies to those adopted by NYU. AAP is pleased, Risher said, that the university is taking responsibility for the behavior and actions of its faculty and hopes that other universities will do the same. The Johns Hopkins University and Yale University already have recommended similar guidelines to their faculty.

AGU, an AAP member, has been trying to educate members about the copyright law and about the financial impact on journals that are widely photocopied, according to Judy C. Holoviak, AGU Director of Publications, Marketing, and Public Information. All AGU journals contain a copyright statement that begins, 'Permission is granted for individuals to make single copies for their personal use in research, study, or teaching, and to use short quotes and figures and tables from this journal for publication in scientific books and journals. There is no charge for any of these uses; AGU requests that the source be cited appropriately.' For uses other than these, AGU participates in the Copyright Clearance Center and collects copying fees through them. The Copyright Clearance Center, located in Salem, Mass., acts as a centralized source for authorization to photocopy for 700 publishers and 6,500 titles.

Nine NYU faculty were named in the original suit; since then, one has died. The nine publishers involved are Addison-Wesley Publishing Co., Inc; Basic Books, Inc., Publishers; Houghton Mifflin Co.; Simon & Schuster, Inc.; Alfred A. Knopf, Inc.; Random House, Inc.; the National Association of Social Workers; Macmillan Publishing Co., Inc.; and Little, Brown & Co.—*BTR*

Law and Guidelines

The text of section 107 of the U.S. copyright law (P.L. 94–553):

'Notwithstanding the provisions of section 106 [exclusive rights in copyrighted works], the fair use of a copyrighted work, including such use by reproduction in copies or phonorecords or by any other means specified by that section, for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright. In determining whether the use made of a work in any particular case is a fair use the factors to be considered shall include—

'(1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes;

'(2) the nature of the copyrighted work;

'(3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and

'(4) the effect of the use upon the potential market for or value of the copyrighted work.'

Highlights of the classroom guidelines:

Teachers may make single copies for scholarly research or for preparations for teaching a class.

Multiple copies (not to exceed more than one copy per student in a course) may be made for classroom use if the copying meets tests of

- brevity. The guidelines set word count limitations for poems, prose, illustrations, and 'special works.' Fitting into the guidelines' definition of brevity are, among others, works of prose of less than 2,500 words; excerpts of 1,000 words or 10% (whichever is less) of a longer piece; and 'one chart, graph, diagram, drawing, cartoon, or picture per book or per periodical issue.'
- spontaneity, defined as copying 'at the instance and inspiration of the individual teacher' and that the 'inspiration and decision to use the work and the moment of its use for maximum teaching effectiveness are so close in time that it would be unreasonable to expect a timely reply to a request for permission.'
- cumulative effect, which means that the copying is for only one course in the school, and, during one class term, not more than one short poem, article, story, essay, or two excerpts may be copied from the same author, nor more than three from the same collective work or periodical volume. For one course during one term professors may have a maximum of nine instances of multiple copying.

In addition, each photocopy must include a notice of copyright.

The guidelines clearly prohibit the use of photocopying to create an anthology, or to substitute or replace anthologies, compilations, collective works, the purchase of books, reprints, or periodicals. In addition, 'There shall be no copying of or from works intended to be "consumable" in the course of study or of teaching,' including workbooks, exercises, standardized tests, and test booklets and answer sheets. Copying of the same item by the same teacher may not be repeated from term to term. Students will not be charged more than the actual photocopying costs.

The guidelines, which are part of the legislative history of the copyright law, were developed in 1976 by the Ad Hoc Committee on Copyright Law Revision, by the author-publisher group of the Authors League of America, Inc., and by Association of American Publishers (AAP). The official and complete set of classroom guidelines is available free of charge from AAP, 2005 Massachusetts Avenue, N.W., Washington, DC 20036. A booklet explaining library photocopying under the photocopying law, 'Photocopying by Academic, Public, and Nonprofit Libraries,' which was prepared in May 1978 by AAP and the Authors League of America, Inc., is available from AAP for $2.

Apollo 18?

Allan Hills, Antarctica, was the site where meteorite sample ALPHA81005 was discovered recently, emprisoned in polar ice (*Eos*, November 30, 1982). Within the past few months there has been an intense effort by several groups of investigators in the United States and a few in Europe to analyze small fractions of what was initially a small (3 × 2.5 × 3 cm) specimen of the meteorite. The reason for the excitement is that A81005 has probably turned out to be a sample of the moon.

Results of the studies are the first tangible evidence that fragments of the moon's surface can be ejected and land on the earth. It is assumed that such a sample escapes from the moon's gravitation after ejection by impact of a meteorite on the lunar surface. It is also assumed, of course, that we know enough about the chemical and physical properties of the moon's surface rocks and minerals to make a positive identification of such a sample. The results of the studies go far beyond the testing of ejecta-trajectory calculations, mass–velocity distribution models, and earth–moon orbital dynamic theories. This sample may be the first evidence of the complex chemical and physical interaction of the earth–moon system.

For now, the excitement and focus of the investigations bears on state-of-the art measurements and analysis to decipher A81005's intricate history. Referring metaphorically to A81005 as being the most recent Apollo mission, R. L. Korotev, L. A. Haskin, and M. M. Lindstrom of the McDonnell Center for the Space Sciences at Washington University, St. Louis, presented a discussion at the March Lunar and Planetary Science Conference 14 (LPSC 14) in Houston entitled 'So Apollo 18 Flew, but Where Did It Sample?' According to them, the Allan Hills sample had a cosmic ray exposure age of no more than about 1.5 million years and a residence time in the Antarctic ice of no more than 600 thousand years, based on ^{10}Be and ^{26}Al values. Compatible with an origin on the moon's surface is the analyzed ratio of FeO to MnO of 65.8 (whole rock determined in A81005 by several investigators and reported at an LPSC 14 special session entitled 'Meteorites from the Earth's Moon.')

W. V. Boynton and D. A. Hill of the Lunar and Planetary Laboratory, *University of Arizona*, Tucson, stated at the conference that 'More convincing data for a lunar origin of A81005 is provided by the abundances of incompatible trace elements.' Their results and those of other groups indicate a close alliance of A81005's patterns of rare earth elements to those of Apollo 16 Highlands breccias. According to Boynton and Hill, 'The presence of a KREEP type pattern in A81005 requires that this meteorite came from the moon.'

Boynton and Hill acknowledge that the component of KREEP (a specialized, extremely fractionated complement of potassium, rare earth elements, and phosphorous found in some lunar Highland rocks), although very closely identified with the moon and its history, could have formed from an identical body somewhere else in space. They conclude, however, that 'It is most unlikely that this pattern could be established on another parent body unless it had a similar bulk composition, size, and thermal history as the moon. Such a parent body clearly does not exist in the solar system.' Such a body could exist outside of our solar system, but even so, the exact conditions that would be required to cause the very extreme fractionations to produce KREEP would be immensely difficult to generate. On the moon, it is thought that the KREEP component fractionation product was formed only once and later was mixed into other rocks that now contain it, such as is observed in many lunar highland anorthositic rocks.

The oxygen isotope compositions show lunar patterns, according to the results determined on A81005 by T. K. Mayeda and R. N. Clayton of the Enrico Fermi Institute, Chicago, Ill., and reported at LPSC 14. In defining this pattern as lunar, Mayeda and Clayton noted that differences in oxygen isotope ratios in various planetary bodies are established at the time of their accretion. 'The earth, the moon, and aubritic meteorites lie on a unique line when plotted on a three-isotope graph. All other extraterrestrial samples are either richer or poorer in ^{16}O. According to Mayeda and Clayton, 'A81005 is identical in isotopic composition with the Apollo 16 breccia, and is distinctly different from the eucrite samples. Of all the known sources of the solar system rocks, only the earth, the moon, and the aubrite parent body have oxygen compositions compatible with that of A81005, . . . leaving the moon as the likely origin.'

If rock fragments from the moon are being found on the earth, it should be possible to explain the processes of ejection and transport. H. J. Melosh of the Lunar and Planetary Laboratory concludes that 'both theory and experiments suggest that significant amounts of ejecta may even exceed the es-

cape velocity of the moon . . .' (LPSC 14). On the basis of observations of explosive behavior, some nuclear, Melosh was able to calculate that fragments relatively free of shock damage are 'spalled off' at the edges of impact craters, the particle size being related to the physical properties of the impacted lunar surface.

Once at velocities exceeding lunar escape, lunar surface ejecta could follow several routes. According to D. E. Gault of the Murphys Center of Planetology in Murphys, Calif., 'it is estimated that the moon is currently losing 10^{9}–10^{10} grams/yr. Of this total mass loss it appears that no more than 10^{7}–10^{8} grams/yr are accreted by earth, the total derived from both direct trajectories and the "cloud" in geocentric orbits (estimated to be of the order of 10^{10}–10^{11} grams).'

The origin, the process, and now a sample whose compositional intricacies decode to a lunar formula, set the scene for a translunar-earth system.—*PMB*

New Funds for Major Equipment

Earth sciences laboratories in the academic world have been in desparate need to replace, improve, or otherwise obtain research apparatus in recent years. The grants available from federal government agencies have not allowed for major equipment purchases, but very recent changes in fund allocation now provide for the purchase of major apparatus for analysis, experimentation, field studies, and for computation and data processing in the earth sciences. Such equipment is described by a guideline brochure recently released by the National Science Foundation (NSF), Division of Earth Sciences, as being 'commonly too expensive and of too broad potential use to be adequately justified by a regular research proposal.' To initiate the program, NSF has allocated $5 million for earth sciences equipment in fiscal year 1984.

There are a few key factors to be considered in applying to the NSF for major research equipment. The title for such a proposal should read 'Acquisition of . . . ,' 'Upgrading of . . . ,' or 'Development of . . . ,' which would imply that money for new, refurbished, or constructed apparatus is being requested. The equipment must be initially intended for a well-defined research project that must be described in detail. Institutional contributions in the form of matching funds and supporting costs would help the application.

The deadline for submission of proposals is September 1, 1983. This provides a relatively short time to prepare a major proposal. A description of the particulars is available from the Data Support Services Section, EAR/EQ, NSF, Washington, DC 20550, or by calling Ian MacGregor, Deputy Division Director, Division of Earth Sciences, at 202-357-9591.—*PMB*

Knapp Confirmed As NSF Director

Edward A. Knapp was confirmed by the Senate in a voice vote on April 15 as the director of the National Science Foundation (NSF). The Senate vote followed a confirmation hearing by the Senate Labor and Human Resources Committee. Knapp, who was nominated by President Reagan to head the foundation in November, had been assistant director for NSF's mathematical and physical sciences (MPS) directorate since July 1982.

Allegations that he has been politicizing NSF have beleaguered Knapp since he asked for resignations or firm commitments to leave from three NSF top administrators in December (two of these administrators had been planning to leave, though no resignation dates had been set). Knapp assured the Senate committee during the April 13 confirmation hearings that he made the decision to ask for the resignations and that, although he had discussed his plan with Office of Science and Technology Policy officials, they did not request that certain people be removed in exchange for particular increases in the NSF budget. Knapp consistently has defended himself against the allegations by saying that he wants his own team at the agency.

The National Sciences Board and Knapp already have sent a list of nominees for the NSF deputy director to the White House for presidential appointment, Knapp told the committee. The post was vacated in December when Donald N. Langenberg resigned from the deputy director post at Knapp's request; Langenberg now is chancellor of the University of Illinois in Chicago.

The NSF director also said that he expects to forward to the White House by early May a list of nominees for two other posts: the assistant director for astronomical, atmospheric, earth, and ocean sciences (the post currently held by Francis S. Johnson), and the assistant director for MPS, which had been vacated by Knapp. Nominees for the assistant director for biological, behavioral, and social science, soon to be vacated by Eloise E. Clark, would follow soon after that.—*BTR*

Clash Over NOAA Budget

At the April 26 hearing on the National Oceanic and Atmospheric Administration's (NOAA) budget by a Senate Appropriations subcommittee, Sen. Lowell P. Weicker, Jr. (R-Conn.), decried the budget cuts proposed by NOAA and the Reagan Administration. 'I think it would be almost criminal' to agree to the proposed cuts, Weicker said, adding that although he understands the broad policy to trim the budget, the proposed cuts amounted to 'piecemeal emasculation . . . I won't be part of it.'

'I cannot help but note with regret that for the third year in a row the Administration proposed drastic reductions in oceans-related research and development,' said Weicker during the hearing conducted by the Senate Appropriations Subcommittee on the departments of Commerce, Justice, and State, and the Judiciary. 'The proposed 37% cut in funding for fisheries programs combined with a 40% cut in other oceans and coastal activities would add up to an $85 million loss for NOAA's oceans programs. To make cuts of this magnitude would be, in effect, to write off the great potential the oceans have for feeding our people and helping to power our economy,' the Connecticut senator said. 'In short, the potential of the oceans as well as the pressures placed upon them have never been so great—and they will be even greater tomorrow. In the face of Administration indifference and outright hostility, Congress must maintain its commitment to the oceans and to the positive contributions they can make to our future.'

The flip side of the coin was presented by NOAA Administrator John V. Byrne: 'I believe our budget represents a balanced approach maintaining essential services in light of the need to exercise fiscal restraint. This budget will result in many changes from the way we have operated in the past, but these changes are for the better—changes that will make NOAA more efficient in meeting our mandated responsibilities.' Byrne also said that the cuts to ocean and coastal programs were made after looking at the overall agency budget, though his personal bias would have been to increase the ocean and coastal programs.

When queried by Weicker about the proposed termination of the Sea Grant program, Byrne told the subcommittee that no one would question the success of Sea Grant. In fact, the Administration felt it was because of its success that the program would be picked up readily by the private sector. Weicker responded that by following such reasoning, the National Institutes of Health would be eliminated also. 'I can assure you there will be a Sea Grant program,' Weicker said. It probably gets the highest number of people and states involved for the lowest number of dollars, he added.

House hearings on the NOAA budget were completed last month. Budget markup sessions in the House were to be held in early May. The Senate markup probably will not be held until the end of the month.—*BTR*

Geophysical Events

This is a summary of *SEAN Bulletin, 8*(3), March 31, 1983, a publication of the Smithsonian Institution. The entire Etna, Kliuchevskoi, and Hunter Island reports are included; also included here is the report on Asama, which will appear in volume 8, number 4. The earthquake report is an excerpt.

The complete bulletin is available in the microfiche edition of *Eos* as a microfiche supplement or as a paper reprint. Subscriptions to *SEAN Bulletin* are also available. For the microfiche, order document E83-004 at $2.50 from AGU Fulfillment, 2000 Florida Avenue, N.W., Washington, DC 20009. For reprints, order *SEAN Bulletin* (give volume and issue numbers and issue date) through AGU Separates; $3.50 for one copy of each issue number for those who do not have a deposit account; $2 for those who do; additional copies of each issue number are $1.00. For a subscription, order *SEAN Bulletin* from AGU Fulfillment. The price is $18.00 for 12 monthly issues mailed to a United States address; $28.00 (U.S.) if mailed elsewhere. Order must be prepaid.

Volcanic Events

Kilauea (Hawaii): Eruption continues in middle east rift zone.
Etna (Sicily): Lava from S flank fissure; central crater enlarged.
Mt. St. Helens (Washington): SO_2 emission, seismicity, and changes in morphology of new lobe may indicate continued endogenous growth.
Long Valley (California): Seismicity declines to near background.
El Chichón (Mexico): Continued monitoring of stratospheric cloud.
Kliuchevskoi (Kamchatka): Earthquake swarm then lava flow from NE flank vent.
Asama (Japan): Incandescent tephra ejected; ashfall to 250 km.
Pagan (Mariana Is.): Tephra deposits suggest 4–7 eruptions since May 1981.
Ulawun (New Britain): Increased seismicity and vapor emission.
Manam (Bismarck Sea): Explosions, ash emissions, and seismicity increase.
Langila (New Britain): Activity declines.
Hunter Island (New Hebrides): Vapor, ash, and burning vegetation.
Mathew Island (New Hebrides): White vapor from central crater.
Ruapehu (New Zealand): Deflation and B-type earthquakes.
White Island (New Zealand): No eruptive activity; B-type events increase.
Erebus (Antarctica): Lava lake level drops slightly; explosion earthquakes; earthquake swarm near area of 1908 thermal activity.
Mt. Melbourne (Antarctica): Fumarolic activity unchanged since 1972.
Rincón de la Vieja (Costa Rica): Tephra eruption from crater lake.
Arenal (Costa Rica): Lava extrusion continues.
Poás (Costa Rica): Fumarole and crater lake temperatures higher.
Soufrière (Guadeloupe): Water temperatures and chemistry.
Ol Doinyo Lengai (Tanzania): Reported February lava flow not found; strong gas emission ends; small ash-poor plumes.

Etna Volcano, Sicily, Italy (37.73°N, 15.00°E). All times are local (UT + 2 h). Most of the following is from a report by Romolo Romano. A destructive south flank fissure eruption began on March 28, preceded by a series of strong earthquakes first felt during the night of March 26–27. At about noon on the 27th, a strong smell of H_2S was noted from an old cone roughly 2 km S of the initial eruption. Seismicity continued through the following night. At about 0845 on March 28 a SSW-trending eruptive fissure opened from about 2450 to 2250 m altitude, roughly 4 km S (bearing about 170°) of the central crater. The base and the E side of this fissure fed several lava flows that initially moved toward the SSE and SSW then turned S. Weak explosive activity along the entire fissure ejected modest quantities of lava fragments. By evening, the main flow had overrun a road and several buildings.

During the morning of April 1, vigorous emission of gas, ash, and old lava, accompanied by occasional phreatic explosions, began from 2 explosion craters upslope at 2700 m altitude. At the end of the day, explosions from the southern vent ejected lava fragments. On April 2, nearly constant lava production formed a 500-m-wide lava field extending to 1900 m altitude. As of April 3, the lava had not advanced below 1450 m altitude, 3.5 km from the fissure. At least four principal effusive vents were active along the 750 m fissure and from its upper part strong gas emission with sporadic explosions occurred at about 30 hornitos.

Bands of open fractures, oriented about N-S, extended from the central crater area to the eruptive fissure. A substantial widening was noted at the S rim of Bocca Nuova, the western of Etna's two central craters and site of frequent collapse activity since Etna's last eruption in March 1981. Strong vapor emissions from Bocca Nuova sometimes included abundant ash. There was no activity from the NE and SE craters.

The temperature of the lava was less than 1100°C and its chemistry (phonolitic tephrite) was similar to that from some of the more recent eruptions. An area of more than 1 km^2 was covered by lava and the volume was estimated at about 8–10 × 10^{6} m^3. The Istituto Internazionale di Vulcanologia considered the eruption to be a typical slow subterminal type. The last activity of this type on the S flank was in 1780. Effusive activity had diminished by April 8 but on April 19 a lava flow 300 m wide and 4 m high was advancing down the S flank and seismicity continued.

The lava destroyed a cable car system that was one of Sicily's most important tourist attractions, and destroyed or seriously damaged more than 20 buildings.

Information Contacts: Romolo Romano, Istituto Internazionale di Vulcanologia, Viale Regina Margherita 6, 95123 Catania, Italy; Maurice Krafft, Equipe de Volcanologie Vulcain, B. P. 5, 68700 Cernay, France; United Press International; Agence France Presse.

Kliuchevskoi Volcano, Kamchatka Peninsula, USSR (56.18°N, 160.78°E). An earthquake swarm on the NE flank of Kliuchevskoi began February 28. The majority of the events had foci above sea level (Kliuchevskoi's summit elevation is 4850 m) and their maximum magnitude was 3. Based on the swarm's character, the Institute of Volcanology predicted that a flank eruption would start between March 4 and 9. On March 8 a crater opened at 3000 m altitude on the NE flank. Activity from the crater was purely effusive, producing an andesitic basalt flow that was 3 km long by March 18.

Information Contact: B. V. Ivanov, Institute of Volcanology, Piip Avenue 9, Petropavlovsk, Kamchatskii 683006 USSR.

Asama Volcano, central Honshu, Japan (36.40°N, 138.53°E). All times are local (UT + 9 hours). An explosive eruption occured from Asama's summit crater April 8. Local seismic activity had increased in mid March, but returned to background level in late March. In early April high-frequency B-type earthquakes and volcanic tremor were observed more frequently than usual.

The eruption began at 0159. The air shock (amplitude, 0.2 millibars) and eruption earthquake (amplitude, 125 microns) were recorded at the JMA Karuizawa Weather Observatory (7.7 km SSE of the crater). Observatory personnel heard the thunder-like sound that accompanied the explosion, and observed the ejection of an incandescent tephra column. During the next 11 minutes, four more eruption earthquakes were recorded; seismic activity then declined rapidly. Only two volcanic earthquakes were recorded between the initial explosion and 0600, when most activity had ceased.

By 0450, when the summit was first visible from the Observatory, a 600-m high, gray plume was being blown WSW from the summit. The wind soon reversed, and ash was carried ENE. Near Ko-Asama, a lava dome about 3 km E of the summit, 2.7 kg m^{-2} of tephra accumulated, including lapilli as large as 1 cm in diameter. By 0600 activity was limited to a 300-m high vapor plume. No further explosions had been recorded by sunset. A forest fire started by the incandescent tephra on the S flank of Asama was extinguished by 0430.

Asama's last eruption was a small explosion on October 2, 1982, 2 days after a sudden increase in seismicity.

Information Contact: Office of Volcanic Observation, Seismological Division, Japan Meteorological Agency, 1-3-4 Ote-machi, Chiyoda-ku, Tokyo 100, Japan.

Hunter Island Volcano, New Hebrides Islands, SW Pacific (22.40°S, 172.05°E). All times are local (UT + 11 hours). A Vanuatu Government team visited Hunter Island on March 9 at 1200. White vapor tinged with gray ash billowed to an altitude of approximately 900 m from the main active crater on the W side, and drifted to the W and NW. Fumaroles and two small superimposed craters on the SE side were also fuming. Vegetation on the lower slopes of the E coast was burning, which suggested that the eruption had begun recently. By 2200, the fires had reached the central spine of the island and could be clearly seen from the anchorage on the NW coast.

The last reported eruption of Hunter Island was November 24, 1895. Aerial photos of Hunter taken in June 1979 showed no activity.

Information Contact: A. McFarlane, Director, Department of Geology, Mines and Rural Water Supplies, GPO, Port Vila, Vanuatu.

Earthquakes

The March 18 earthquake was the strongest to occur in the New Guinea–Solomon Islands area in 12 years, but no casualties were reported and the only major structural damage was the collapse of a concrete pier at Muliama on the E coast of New Ireland (about 100 km NW of the epicenter). Four small tsunamis with a maximum amplitude of 25 cm were recorded between 0945 and 1145 UT in Rabaul harbor (about 170 km WSW of the epicenter). Landslides and snow avalanches triggered by the March 25 earthquake about 80 km NE of Tehran killed about 90 motorists and injured about 40 on the Haraz highway between Tehran and Amol, on the Caspian Sea. Two mountain villages were reported leveled, with about 10 persons dead. Another shock the next day, in virtually the same place, caused more injuries and damage. At least 225 persons were killed in Popayán, capital of Cauca department, by the March 31 earthquake. In nearby towns, including Piendamó, Morales, and Timbío, 16 were killed. About 1500 were injured, 100,000 left homeless. The widely felt shock destroyed 80% of the city, including the airport runway. The epicenter was almost beneath the city, and the MMi there was VIII.

Date	Time (UT)	Magnitude	Latitude	Longitude	Depth of Focus	Region
March 8	1707	5.9 m_b	10.86°N	62.08°W	99 km	Off NE Venezuela
March 12	0137	6.5 M_s	4.10°S	127.92°E	shallow	Banda Sea
March 15	1727	5.1 m_b	34.84°N	137.40°E	45 km	Honshu, Japan
March 18	0906	7.8 M_s*	4.86°S	153.51°E	88 km	Solomon Islands
March 23	2351	6.0 M_s	38.57°N	20.60°E	10 km	W Greece
March 25	1158	5.1 m_b	35.96°N	52.33°E	shallow	N Iran
March 26	0407	5.3 m_b	36.17°N	52.17°E	shallow	N Iran
March 31	1313	5.5 m_b	2.43°N	76.63°W	10 km	SW Colombia

*University of California, Berkeley, magnitude 7.9

Information Contacts: National Earthquake Information Service, U.S. Geological Survey, Stop 967, Denver Federal Center, Box 25046, Denver, Colorado 80225 USA; P. Lowenstein, Senior Government Volcanologist, Rabaul Volcano Observatory, P.O. Box 386, Rabaul, Papua New Guinea; J. Rafael Goberna, S.J., Universidad Javeriana, Inst. Geofisico, Cra. 7, No. 40-62, Apartado Aereo 56710, Botota, D.E., Colombia; Islamic Republic News Agency, Tehran, Iran; Agencia EFE, S.A., Madrid, Spain; United Press International.

Meteoritic Events

Meteorite Fall: Tennessee, USA, January 28; petrographic information.
Fireballs: East Germany; southern California, USA.

Classified

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For further information, call toll free 800-424-2488 or, in the Washington, D. C., area, 462-6903.

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Hydrologist/Environmental Scientist. Ph.D. research associate seeks research/teaching position. Research areas include soil water dynamics, watershed modeling, hillslope hydrology, contaminant transport. Interested also in climatology and ecology. Would consider also a nonacademic job. Box 818, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009.

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Columbia University is an equal opportunity/affirmative action employer.

Structural Geology/Petrology. Lafayette College seeks a person to teach undergraduate physical and structural geology, igneous and metamorphic petrology, and additional courses, dependent on applicant's interests. Ability to teach introductory geophysics is desirable but not mandatory. Teaching load averages ten to twelve contact hours and two courses/semester. Appointment as assistant professor (Ph.D. complete) or instructor (Ph.D. pending).

Send application and resume, and arrange for three reference letters to Dr. Richard W. Faas, Department of Geology, Lafayette College, Easton, PA 18042.

Lafayette College is an equal opportunity employer, M/F. Women and minorities are encouraged to apply.

University of Colorado, Boulder, Geochemist Position. Geochemist with active research program, stable isotopes, radioactive isotopes, and/or trace elements is being sought for a joint appointment in the Department of Geological Sciences and the Cooperative Institute for Research in Environmental Sciences (CIRES) of the University of Colorado.

The one-half time position within the Department of Geological Sciences is tenure track at the assistant or associate professor level with a starting salary of $12,000–$15,000 for the academic year.

Teaching load will be half that of full-time faculty. The position within CIRES will be as a Fellow with appropriate office and laboratory space. One-half academic year salary will be guaranteed by CIRES for two years at the departmental rate, after which incumbent must generate his/her CIRES salary from external sources. Incumbent may augment salary further by generating three months of summer salary from contracts and grants, and consulting.

Applicants with experience, publications, and/or movable existing research equipment preferred. Preferred starting date would be January 1, 1984. Closing date for applications is October 1, 1983.

Applications should include statement of research and teaching interests, experience, a full vitae, and four letters of reference.

Apply to: Professor Charles Stern, Chairman, Geochemist Search Committee, Department of Geological Sciences, Campus Box 250, University of Colorado, Boulder, CO 80309.

The University of Colorado is an equal opportunity/affirmative action, Section 504 employer.

Fellow in Geochronology and Isotope Geochemistry/The Australian National University. THE AUSTRALIAN NATIONAL UNIVERSITY invites applications for FELLOW IN GEOCHRONOLOGY AND ISOTOPE GEOCHEMISTRY, RESEARCH SCHOOL OF EARTH SCIENCES.

Applicants should have an established scientific reputation, experience in the use of radiogenic isotopes particularly of neodymium and strontium, and a proven ability to manage projects involving chemical and mass spectrometric techniques.

Salary in accordance with qualifications and experience within the range: Fellow $26148–$35031. Current exchange rates: $A1 = $US0.86 = UK57P.

Appointment will be: Fellow for an initial period of five years with the possibility, following review, of reappointment to retiring age. Grants are provided towards travel and removal, assistance with housing; superannuation.

The University reserves the right not to make an appointment or to make an appointment by invitation at any time.

Applicants may obtain further particulars from The Registrar, The Australian National University, P.O. Box 4, Canberra, Australia, with whom applications close on 21 June 1983.

Research Associate. The Stanford University School of Earth Sciences and the Center for Materials Research seek research-oriented scientist for an initial three-year appointment to start approximately October 1 1983 whose responsibilities will include (1) Supervision and maintenance of a new XRF-XRD facility
(2) Supervision of a new ESCA spectrometer, and (3) interaction with our microprobe technician in optimizing software for geological applications.

Duties will include training faculty and student users of the XRF, XRD, and ESCA, but not service work. Experience in operation of XRF, XRD, and/or electron microprobe required, we will train on the ESCA. A good working knowledge of DEC Series 11 computers (11/02, 11/23, 11/34) operating under the RSX-11M monitor and of FORTRAN level programming is essential. Although we envision that the duties associated with this new equipment will constitute a full-time job for a year or two, we prefer Ph.D.-level applicants who desire eventually to develop their own research program in conjunction with Stanford geology faculty.

Send C.V. to Gail Mahood, Department of Geology, Stanford University, Stanford, CA 94305.

Stanford University is an equal opportunity/affirmative action employer.

Research Assistantships for Studies in Air Pollution and Atmospheric Chemistry/Washington State University. For MS or Ph.D. in Engineering or Environmental Science. Graduate degree programs can also lead to specific degrees in Chemical Engineering, Mechanical Engineering, or Environmental Engineering. Individual programs can be designed to fit student background, special interests, and experience.

Current research programs include: Antarctic studies (including field and winterover programs), pollutant transport, tracer studies, complex terrain modeling, biogenic emissions, global atmospheric chemistry, and atmospheric monitoring.

Candidates are sought with BS in meteorology (or equivalent), chemistry, physics or engineering. Stipend is $6,900/nine month; $11,500/twelve in some cases. Tuition assistance available to suitable candidates. September 1983 and February 1984 enrollments available.

Contact E. Robinson, Air Pollution Program, 306 Dana Hall, Washington State University, Pullman, Washington 99164-2730 or telephone collect for further information 509-335-1526.

EO/AAE.

Mesoscale Research Section of the Atmospheric Analysis and Prediction Division (AAP)/Ph.D. Scientist I or II (Two Positions). The National Center for Atmospheric Research in Boulder, Colorado is recruiting for Scientist I or II to do basic research studies on small-scale or mesoscale meteorology. The research will be selected and defined in collaboration with the senior staff. The primary emphasis will be in advancing the fundamental understanding of important mesoscale processes and their interactions with smaller scales of motion. Both theoretical and observational studies will be encouraged; the main goal is to improve the skill of mesoscale forecasting.

REQUIRES (LEVEL I):
- Ph.D. dissertation or equivalent research contribution in meteorology or related field.
- Demonstrated expertise/interest in small-scale or mesoscale meteorology
- Demonstrated skill in effective written and oral communication
- Strong mathematical background

ADDITIONAL REQUIREMENTS (LEVEL II):
- Several years of research experience in mesoscale meteorology or related area
- Publication record reflecting the quality and productivity of past research

Salary range: 82, $25,814—$38,722/year, (LEVEL I) 83, $30,977—$46,466/year, (LEVEL II)

Note: the Scientist I and II appointments are terms of up to three and four years respectively. Individuals may then be appointed to II or III position in accordance with UCAR policy.

Send resume PROMPTLY to Esther Blazon, NCAR, P.O. Box 3000, Boulder, CO 80307, or call (303) 494-5151, Ext. 581 or 666 for information.

Equal Opportunity Employer.

Faculty Position in Sedimentary Geology at the University of South Carolina. Applications are invited for a tenured track faculty position in the Department of Geology with a specialization in sedimentology starting as early as August 1983.

Ph.D. required. Rank and salary are open depending on qualifications and experience. We seek a candidate whose research interests are in one or more of the following fields: carbonate depositial systems, basin analysis, global sediment cycling, stratigraphy and sedimentary geochemistry.

The successful candidate is expected to develop a strong research program with external funding, supervise graduate students, and teach graduate and undergraduate courses. Send letter of application, vitae, statement of research interests, and names of three references to: Dr. Robert C. Thunell, Department of Geology, University of South Carolina, Columbia, SC 29208.

The University of South Carolina is an equal opportunity/affirmative action employer.

Director, Texas Water Resources Institute/Texas A&M University. QUALIFICATIONS: Ph.D. in discipline related to water research and established record of research in one or more water-related fields. Experience in research administration is desirable.

DUTIES AND RESPONSIBILITIES: The Director plans and manages state-wide water resources research and information programs. The Institute serves as a focal point for water research at Texas A&M University and sponsors research at several universities across the state. The Director manages the Title I Program of the Office of Research and Technology in the Department of the Interior; an information and technology transfer program which communicates research results to potential users is a significant component of the Institute's program. Interaction with water agency officials throughout the state and nation is an important aspect of the Director's responsibilities. The Director serves as a coordinator of the water research program in the Texas Agricultural Experiment Station and for water-related, educational programs in the Texas Agricultural Extension Service. Close association with Texas A&M University provides the opportunity to participate in graduate programs of academic departments with significant activities in water research. Academic appointment in the appropriate department is available. The Institute is administratively assigned to the Texas Agricultural Experiment Station with the Director reporting to the Director of the Texas Agricultural Experiment Station. For matters related to the technology transfer program, the Director is responsible to the Director of the Texas Agricultural Extension Service.

BACKGROUND: The Texas Water Resources Institute had its origin in the early 1950's and was formally designed as an institute by the Governor in response to federal legislation in 1964. Funding for support of its program comes from federal, state, and private sources. A broad-based Water Resources Officials Advisory Committee assists the Director in identifying the important water research needs in the state. A Multi-disciplinary Program Planning Committee is used to ranslate the research needs into well-defined research programs which will be considered for sponsorship by the Institute. An important role of the Institute is that of serving as a state-wide focal point for water research and, thereby, working with a broad array of agencies, institutions, and organizations. The significance of this role is emphasized by the fact that water supply and distribution is the most critical issue in Texas. In recognition of the critical nature of water problems in the state, the Institute is planning a major expansion of its programs. Increased emphasis will be placed on technology transfer and increasing the scope of sponsored research. New resources will be sought to accomodate this expansion as well as to increase the magnitude of effort on existing programs.

POSITION AVAILABLE: July 1983.

Nominations and applications with current curriculum vitae and the names of at least three references should be sent to:

Edward A. Hiler, Chairman
TWRI Director Search Committee
Department of Agricultural Engineering
Texas A&M University
College Station, Texas 77843

The Texas Agricultural Experiment Station is an Equal Opportunity/Affirmative Action Employer.

Postdoctoral Fellowship or Research Associateship in Geophysics at the University of Toronto, Erindale Campus. Salary: PDF, $16,500—$19,500 depending on experience; Research Associate (more than two years from Ph.D.), minimum $19,500. Duration: one year, from July 1, 1983; renewable for a second year if funding permits.

The successful candidate will be responsible for teaching a third-year undergraduate half-course in Physics of the Earth and will carry on research in Precambrian paleomagnetism and/or chemical remanent magnetization.

Qualifications: Ph.D. in paleomagnetism or rock magnetism and at least one year's lecturing experience. For appointment as a Research Associate, two or more years' experience in paleomagnetic research beyond the Ph.D. is required.

In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada.

Send curriculum vitae and the names of three referees to: Dr. D.J. Dunlop, Erindale College, 3359 Mississauga Road North, Mississauga, Ontario, Canada L5L 1C6.

GFD Position/Texas A&M University. The Department of Oceanography of Texas A&M University has an opening for a tenure track assistant professor in physical oceanography to be filled by 1 September 1983.

Preference will be given to candidates with strong theoretical background in geophysical fluid dynamics.

The successful applicant will be expected to teach undergraduate and graduate courses and to conduct a vigorous research program in his or her specialty. A Ph.D. is required for this position and one year's experience in a postdoctoral position is desired. Salary is negotiable depending upon experience and qualifications.

Applicant should submit a vita along with a letter describing his/her research and teaching goals and names of five persons for reference to Professor R.O. Reid, Head, Department of Oceanography, Texas A&M University, College Station, TX 77843.

The closing date for applications is May 31, 1983.

Texas A&M University is an affirmative action/equal opportunity employer.

Igneous or Metamorphic Petrology. The Department of Geology seeks to fill a tenure track position in petrology beginning either August 15, 1983 or January 1, 1984. Appointment will be at the rank of assistant professor. Postdoctoral experience is considered important. The successful candidate will be expected to develop an aggressive research program, teach both graduate (Ph.D., MS) and undergraduate levels and interact with an active group of faculty and students in mineralogy, petrology and geochemistry. Research facilities in the department include: automated electron microprobe, solid-source mass spectrometer, gas-source mass spectrometer, SEM, AA, non-automated XRF, and Harris 500 computer. Please send a resume, a statement of research interests and the names of at least three references to: Chairman, Petrology Search Committee, Department of Geology, Northern Illinois University, DeKalb, Illinois 60115.

Applications will be accepted until position is filled.

Northern Illinois University is an equal opportunity/affirmative action employer.

Research Positions for Mathematical Physicists. Applications are invited for several research positions at the Center for Studies of Nonlinear Dynamics, La Jolla Institute, beginning summer 1983. Current research involves work on nonlinear wave-wave interactions, acoustic, optical, and radio wave propagation in random media, and fluctuation phenomena in the statistical mechanics of chemical and geophysical systems. Physicists and applied mathematicians who are interested in working on problems of the above type should send resumes and arrange for three letters of recommendation to be sent to Dr. Stanley Flatte, Director, CSND, La Jolla Institute, 8950 Villa La Jolla Drive, Suite 2150, La Jolla, California 92037.

La Jolla Institute is an equal opportunity/affirmative action employer.

UNIVERSITY OF GLASGOW DEPARTMENT OF GEOLOGY

LECTURESHIP IN CRUSTAL SEISMOLOGY

Applications are invited for a new Lectureship in Crustal Seismology tenable in the Department of Geology from October 1983. The Department occupies a new 5 floor building, has 16 full-time and 3 part-time academic staff and is equipped with seismographs and other geophysical equipment.

Applicants should be not more than 35 years of age. Salary will be within the range £6375–£13,505 on the Lecturers' scale (under review) with placing according to age, qualifications and experience.

Further particulars may be obtained from the Secretary of the University Court, (Room 18), University of Glasgow, Glasgow G12 8QQ with whom applications (8 copies; 1 copy in the case of overseas applicants), giving the names and addresses of three referees, should be lodged on or before 20th May, 1983. Late applications from overseas will be considered; telegram in the first instance if necessary.

In reply please quote Ref. No. 4965.

Geology (with emphasis on petrology)/University of California, Riverside. Visiting Lecturer opening beginning 1 September 1983. Although the initial appointment will be as a lecturer, and is annually renewable, the appointment could lead to a ladder faculty position next year.

Appointee would teach at both undergraduate and graduate levels and should be able to teach several of Petrology, Mineralogy, Geochemistry, Field Geology, Physical Geology. Ph.D. required. In addition to teaching, research and service are required of faculty members at the University of California.

Applicants should submit a current curriculum vita with names and addresses of three people who have agreed to provide references. Applications should be complete by July 30, 1983; however, late applications may be accepted until successful candidate is appointed.

Send applications to Dr. Lewis H. Cohen, Department of Earth Sciences, University of California, Riverside, California 92521.

The University of California is an Equal Opportunity/Affirmative Action Employer.

The University of Bergen/Chair in Solid Earth Physics (Marine Geophysics). Salary is on the scale 31, Nkr. 192.589 p.a. gross, of which Nkr. 3.301 p.a. are paid in pension contributions.

The chair will be appointed on the understanding that any changes in scientific duties, pension or retiring age made by law or by the King with the agreement of Parliament are to be accepted without compensation.

Applicants should submit five copies of scientific work—published or unpublished— which they wish to be considered for the appointment as well as six copies of a list of all scientific contributions with information on where they were published. Scientific contributions are to be submitted, in numbered order and in five groups, to the science faculty of the University of Bergen within one month of the closing date for applications. Scientific manuscripts in preparation may be submitted within three months of the closing date for applications provided notice of intent is given on submitting the other publications. Applicants are otherwise referred to the current rules for the procedure to be followed in the appointment of professorships and readerships.

A resume of the vacant chair can be obtained on request from:

Det matematisk-naturvitenskapelige fakultet
postboks 25
5014 Universitetet i Bergen
Norway

By decision of the collegium applications from women are especially encouraged.

Applications, which must include a complete curriculum vitae, should be addressed to the King and be sent together with relevant certificates and one copy of a list of publications to Det matematisk-naturvitenskapelige fakultet, postboks 25, 5014 Universitetet i Bergen before August 12th, 1983.

Temporary Position: Igneous Petrology and Geophysics/ University of Montana. Applications are invited for one sabbatical replacement at the instructor or assistant professor level for winter and spring quarters of 1983–84 academic year. The period of contract obligation will be approximately January 3, 1984 to June 8, 1984. A graduate student who will have completed a doctorate before September 1983 or anticipates completion sometime during the period of employment would be appropriate for this division.

The Department is looking for someone to teach undergraduate igneous petrology and perhaps a course in geophysics. The average department course load per quarter is two courses.

The position is replacing a faculty member on sabbatical and therefore is not permanent or on a tenure track. To apply send a resume and two letters of recommendation to: Arnold J. Silverman, Chairman, Department of Geology, University of Montana, Missoula, MT by May 15, 1983.

The University of Montana is an equal opportunity/affirmative action employer.

Meteorologist/System and Applied Sciences Corporation (SASC). Immediate opening. To develop algorithms for operational prediction of atmospheric extinction in visible and near-IR. MS and experience in radiative transfer and FORTRAN required. Resume to SASC, 109 Massachusetts Avenue, Lexington, MA 02173. Attention: Dr. A.M. Gerlach.

SASC is an equal opportunity/affirmative action employer.

University of Georgia/Faculty Positions. The Department of Geology anticipates hiring as many as five people at the rank of Assistant or Associate Professor, on either a permanent (tenure track) or temporary basis.

Duties include teaching undergraduate and graduate courses and conducting research.

Teaching/research specializations to be considered include: economic geology, geochemistry, mineralogy/petrology, paleontology, sedimentation, structural geology, geophysics, and marine geology.

Letter of application—including a statement of specific teaching and research interests, curriculum vita, and names and addresses of three references—should be sent to: Head
Department of Geology
University of Georgia
Athens, GA 30602.

Deadline for receipt of applications is June 20, 1983. Should sufficient candidates not be found, another search may be opened.

The University of Georgia is an equal opportunity/affirmative action employer.

SERVICES, SUPPLIES, COURSES, AND ANNOUNCEMENTS

Seismic Risk/University of Antilles-Guyane at Pointeà Pitre (Guadeloupe). Objectives. The school will give a modern and multidisciplinary view of the problem of seismic risk. It will integrate state of the art knowledge about tectonics, focal mechanism of earthquakes, near field recordings and techniques of seismic engineering. It will be addressed to students having a background eqivalent to Master in Geophysics, an engineering degree or a postgraduate training in sciences.

The courses will cover three main subjects:
(1) Seismic risk and seismotectonics,
(2) Caribbean subduction, and
(3) Seismic engineering.

The school is open mainly to French students, students from South America, Central America, and the Caribbean region, and from the United States. The school will take place on the campus of the University of Antilles Guyane at Pointeà Pitre (Guadeloupe) from July 17 to July 30, 1983. Scientific Committee: R. Gaulon, A. Cisternas, J.M. Vila, Institut de Physique du Globe 4, Place Jussieu, Tour 14 24, 75230 Paris Cedex 05, France.

Hydraulics and Transport of Pollutants in Groundwater/University of California, Irvine. State-of-the-art technology relating to groundwater pollution analysis will be presented in "Hydraulics and Transport of Pollutants in Groundwater," a five-day short course offered through University of California, Irvine Extension Monday-Friday, July 25–29, 1983. Specifically, the course will cover fundamental principles of groundwater flow and pollution transport in the zone of aeration and zone of saturation. Geochemical processes and the determination of transport parameters will be presented. The sources and control of pollutants and their long-term effects on aquifers will be evaluated. The course includes case histories and modern mathematical modeling and computer simulation techniques. The faculty includes Professor Jacob Bear, Albert and Ann Mansfield Chair in Water Resources at Technion, Haifa, Israel; Yoram J. Litwin, President of RAMLIT Associates, Berkeley, California and faculty member in the Hydraulics and Sanitary Division of UC Berkeley; T.V. Hromadka II, Hydrologist, Water Resources Division, U.S. Geological Survey, and Gary L. Guymon, Professor of Civil Engineering, UC Irvine. Course fee is $750 and includes course materials, lunches, one dinner and parking. For more information, contact UC Irvine Extension, P.O. Box AZ, Irvine, CA 92716; 714-833-5414.

Large-Scale Computations in Fluid Mechanics. An AMS-SIAM Summer Seminar in Applied Mathematics will be held June 27-July 8, 1983 at Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California. The members of the organizing committee are Alexandre J. Chorin (University of California, Berkeley), Bjorn E. Engquist (University of California, Los Angeles), Stanley J. Osher (University of California, Los Angeles), and Richard C.J. Somerville, Chairman, (University of California, San Diego).

The purpose of this seminar is to bring scientists interested in computational fluid mechanics together with numerical analysts and mathematicians working in large-scale computations. The numerical modeling includes geophysical problems such as those of the atmosphere, ocean, and interior of the earth and planetary, solar, and stellar atmospheres. For further information contact the Meetings Department, American Mathematical Society, P.O. Box 6248, Providence, RI 02940. (Please refer to the display ad appearing in EOS, vol. 64, No.17.)

AGU

SEASAT II Special Issue

SEASAT II, a special issue of the *Journal of Geophysical Research* (JGR) dedicated to scientific results from the SEASAT Mission, was recently published and mailed to JGR-Green subscribers (vol. 88 (C3)). Reprints of this issue are being sent to a selected number of JGR-Red subscribers as well as to everyone on the JPL or NASA Headquarters Oceanographic Remote Sensing mailing lists. If you are not on these mailing lists or have not received a copy in 8 to 10 weeks, you may obtain one by contacting:

Katie Kerr, Librarian
Oceanic Remote Sensing Library
Jet Propulsion Laboratory, MS 111-113
4800 Oak Grove Drive
Pasadena, CA 91109.

When this supply of the reprint volume is exhausted, additional copies will be available for $10 each from the American Geophysical Union, 2000 Florida Ave., N.W., Washington, DC 20009. All orders must be prepaid.

Membership Applications Received

Applications for membership have been received from the following individuals. The letter after the name denotes the proposed primary section affiliation; the letter A denotes the Atmospheric Sciences section, which was formerly the Meteorology section.

Regular Member

Elizabeth B. Burnett (SA), Robert W. Corell (O), Harry A. DeFerrari (O), Robert F. Dill (O), James J. Dlubac (S), D. J. Dushman (S), Bruce E. Ehleringer (H), Rodger T. Faill (T), Marcos Fridman, Erast B. Gliner (SS), Harold F. Hemond (H), Ulrich Hornung (H), David L. Jones (T), William S. Kamminga (O), George A. Kuczera (H), James I. Lyons (V), Bernard Massinon (S), Kirk D. McIntosh (T), Dewey M. McLean (O), Drew Morris (S), Louis Otto Nicolaysen (T), Peter C. Patton (H), Samuel J. Ratick (H), Tom G. Slanger (SA), Montgomerie Steele (T), M. Llewellyn Thatcher (H), Robert Paul Trucine (O), Marek Truchan (S), Howard S. Wheater (H).

Student Member

Forrest A. Carroll (H), Hesham Elabd (H), Anne Erdmann (T), Harindra Fernando (A), Sirpa M. A. Hakkinen (O), Uk Han, Royce Brooks Hanson (V), Gwendolyn L. Hofler (S), Sung K. Kim, David A. Kring (P), Craig R. Light (H), Viola Robertson-Daley (S), Burkhard Schaffrin (G), Satish S. C. Singh (S), George Thomas (GP), Ashok K. Verma (H), Leonard John Walstad (O), Norbert Weinreich (GP).

Associate Member

Keith Grant (T), Steven T. Keirstead (H), Holly F. Ryan (O), Janet G. Snyder (V).

Supporting Members

Individuals

All dues-paid members contributing an additional $80 or more in any single year earn recognition as Individual Supporting Members for that year. Among the present Individual Supporting Members, there are 15 Life Supporting Members. To have achieved this special recognition, they have contributed $1500 or more thus far during the AGU-GIFT program. As a benefit (or dividend) they have no further dues obligations.

Life Supporting Members

L. Thomas Aldrich
Allan V. Cox
Samuel S. Goldich
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Paolo Lanzano
Murli H. Manghnani
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Peter S. Eagleson, Gordon P. Eaton, E. R. Engdahl, Robert S. Finn, Irene K. Fischer, Robert D. Fletcher, James M. Forgotson, Herbert Friedman, John J. Gallagher, Jr., J. Freeman Gilbert, William C. Grausteln, Thomas I. Gray, Jr., Edwin T. Green, David Greenewalt, Richard Groeber, John K. Hall, Louis P. Harrison, Warren W. Hastings, Charles E. Helsley, J. B. Hersey, Edward P. Hollis, John N. Howard, Kenneth L. Hunkins.

David S. Johnson, Albert W. Kaddatz, William M. Kaula, William W. Kellogg, Carl Kisslinger, John A. Knauss, Max A. Kohler, Serge A. Korff, Dale C. Krause, Irving P. Krick, Joseph W. Lang, Gordon G. Lill, J. Virginia Lincoln, Paul A. Lindberg, James P. Lodge, Jr.

Alexander Malahoff, Thomas F. Malone, Elwood Maple, William Markowitz, Ronald G. Mason, Gilbert D. Mead, Jaylee M. Mead, Buford K. Meade, Leslie H. Meredith, J. Murray Mitchell, Jr., Christopher N. K. Mooers, Wendell J. Mordy, Jerome Namias, Norman F. Ness, L. L. Nettleton, Worth D. Nowlin, Jr., Hugh Odishaw, Feodor Ostapoff, Ned A. Ostenso, Louis C. Pakiser, O. Scott Petty,

Louis O. Quam, John C. Reed, Richard J. Reed, Joseph L. Reid, Paul G. Richards, Malcolm Rigby, Eugene C. Robertson, Juan G. Roederer, Claes G. H. Rooth, Morton J. Rubin, William B. F. Ryan, Michael Schulz, Alan H. Shapley, Joseph V. Smith, Waldo E. Smith, Kenneth C. Spengler, Athelstan Spilhaus, Thomas W. Stern, Glenn E. Stout, Verne E. Suomi, George H. Sutton, Kendall L. Svendsen.

Manik Talwani, Charles V. Theis, George A. Thompson, M. Nafi Toksoz, C. N. Touart, Richard P. Turco, Thomas S. Vanasek, John W. Vanderwilt, Pierre Verdeil, Clyde Wahrhaftig, Martin Walt, Karen M. Ward, Harvey O. Westby, Loren D. Wicks, Ralphe Wiggins, Owen W. Williams, J. Tuzo Wilson, Abel Wolman, Frederick E. Wright, Oliver R. Wulf, Gordon A. Young, John M. Zeigler.

Organizations

Many organizations show their support of the objectives of the AGU through supporting membership in one of the following dues categories:

Sustaining Members	$2,100
Contributing Members	$1,050
Supporting Members	$350

Such affiliation is the company's public avowal that it is committed to the support of the objectives of the Union and to the fulfilling of the needs of its scientific staff.

Sustaining Members

Shell Development Company

Contributing Members

Chevron Oil Field Research Company
IBM

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Exxon Production Research Company
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Institut für Meteorologie und Geophysik, Universität Innsbruck
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Phillips Petroleum Company
Schonstedt Instrument Company
Sprengnether Instruments, Inc.
Teledyne/Geotech Division
Texaco, Inc.
TRW, Inc./TRW Systems Group
UCAR
Western Geophysical Company

Meetings

Announcements

Global Carbon Cycle

The Sixth Oak Ridge National Laboratory Life Sciences Symposium will be held October 31-November 2, 1983, in Knoxville, Tenn. 'The Global Carbon Cycle: Analysis of the Natural Cycle and Implications of Anthropogenic Alterations for the Next Century' will be the meeting's theme.

Sessions will include the historical record of atmospheric CO_2 and its implications; isotopic and geologic time series as proxy records of carbon cycle processes; the role of ocean biogeochemistry in the global carbon cycle; mathematical models of the global carbon cycle; the influence of the world's biosphere on changes in atmospheric CO_2 levels; and past and future releases of CO_2 from fossil fuel combustion.

The meeting will be cosponsored by the U.S. Department of Energy, the National Science Foundation, the National Oceanic and Atmospheric Administration, the Electric Power Research Institute, and the Gas Research Institute.

Symposium proceedings are to be published commercially. For additional information contact Debbie Shepherd, Oak Ridge National Laboratory, P.O. Box X, Building 1505, Oak Ridge, TN 37830 (telephone: 615-574-7302).

AGU CHAPMAN CONFERENCE ON MAGNETIC RECONNECTION

October 3-7, 1983
Los Alamos, New Mexico
Convenor: E. W. Hones, Jr.

Abstract Deadline: July 1, 1983

Invited and contributed papers

Topics
- Theory of Reconnection
- Computer Models of Reconnection
- Reconnection in Earth's Magnetotail
- Reconnection at Earth's Magnetopause
- Reconnection in Laboratory Plasmas
- Reconnection in Astronomical Objects

Contact:
AGU Meetings:
2000 Florida Avenue, N.W.
Washington, D.C. 20009
(202) 462-6903 D.C. area
toll free 800-424-2488

Call for papers published in EOS, March 29, 1983

Geophysical Year

New Listings

The complete Geophysical Year last appeared in the December 21, 1982, *Eos*.

A boldface meeting title indicates sponsorship or cosponsorship by AGU.

May 24, 1983 Water Resources Planning for the Missouri River Basin. Sponsors, College of Engineering and Engineering Extension of the University of Missouri-Columbia; the University of Missouri Water Resources Research Center; the University of Missouri-Rolla Institute for River Studies; the Iowa State University Water Resources Research Institute; the Midwest Research Institute; the Missouri River Shippers and Operators Committee of the Missouri River Basin Association; and the U.S. Corps of Engineers, Kansas City district. (Virginia Nettleton, University of Missouri-Columbia, telephone: 314-882-2087.)

June 1–4, 1983 Coastal Zone 83, 3rd Symposium on Coastal and Ocean Management, San Diego, Calif. (Orville T. Magoon, General Chairman, Coastal Zone 83, P.O. Box 26062, San Francisco, CA 84126).

July 6–8, 1983 1983 National Conference on Environmental Engineering, Boulder, Colo. Sponsor, Environmental Engineering Division of the American Society of Civil Engineers. (Allen J. Medine, Civil and Environmental Engineering, University of Colorado, Boulder, CO 80309; telephone: 303-492-6069).

October 31-November 2, 1983 Sixth Oak Ridge National Laboratory Life Sciences Symposium, Knoxville, Tenn. Sponsors, U.S. Department of Energy, the National Science Foundation, the National Oceanic and Atmospheric Administration, the Electric Power Research Institute, and Gas Research Institute. (Debbie Shepherd, Oak Ridge National Laboratory, P.O. Box X, Building 1505, Oak Ridge, TN 37830, telephone: 615-574-7302).

Geological Society of America Annual Meetings (Jean Latulippe, Geological Society of America, P.O. Box 9140, Boulder, CO 80301; telephone: 303-447-2020):

October 31-November 3, 1983 Indianapolis, Ind.; **November 5–8, 1984** Reno, Nev.; **October 14–17, 1985** Boston, Mass.; **November 10–13, 1986** San Antonio, Tex.; **October 26–29, 1987** Phoenix, Ariz.

February 20–24, 1984 Chapman Conference on Collisionless Shock Waves in the Heliosphere, Napa, Calif. (Meetings, AGU, 2000 Florida Avenue, N.W., Washington, DC 20009.)

American Congress on Surveying and Mapping National Meetings (Willard A. Kuncis, 4415 Jensen Pl., Fairfax, VA 22032; telephone: 202-425-8790):

March 11–16, 1984 Washington, D. C.; **March 10–15, 1985** Washington, D. C.; **March 16–21, 1986** Washington, D. C.

May 21–23, 1984 International Groundwater Symposium on Groundwater Resources Utilization and Contaminant Hydrogeology, Montreal, Canada. Sponsors, Canadian National Chapter of the International Association of Hydrogeologists, and the Canadian Water Well Association. (A. Kohut, Chairman, International Groundwater Symposium Montreal '84, Ministry of the Environment, 765 Broughton Street, Victoria, British Columbia, Canada V8V 1X5).

May 24–26, 1984 Symposium on the History of Soil and Water Conservation, Columbia, MO. Sponsors, Missouri Cultural Heritage Center at the University of Missouri, the Agricultural History Society, and the Soil Conservation Service of the U.S. Department of Agriculture. (Susan Flader, Department of History, University of Missouri, Columbia, Missouri 65211, telephone: 314-882-2481 or 314-442-1058; or Douglas Helms, Historian, Soil Conservation Service, P.O. Box 2890, Washington, D.C. 20013, telephone: 202-382-0049)

May 29-June 1, 1984 Joint Meeting of the 11th Annual Meeting of the Canadian Geophysical Union and the 18th Annual Congress of the Canadian Meteorological and Oceanographic Society, Nova Scotia, Canada. (Atlantic Oceanographic Laboratory, Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2).

June 25–27, 1984 Symposium of the Achievements of the International Magnetospheric Study, Graz, Austria. Sponsor, Scientific Committee on Solar-Terrestrial Physics of the International Council of Scientific Unions. (J. G. Roederer, Geophysical Institute, University of Alaska, Fairbanks, AK 99701).

Changes

June 26–28, 1984 International Symposium on Deep Structure of the Continental Crust: Results from Reflection Seismology, now cosponsored by AGU.

AGU Honors

1983 Medalists and Awardees

Syun-iti Akimoto - Bowie Medal
John W. Handin - Bucher Medal
Fred Noel Spiess - Ewing Medal
S. Keith Runcorn - Fleming Medal
William L. Chameides - Macelwane Award
Donald J. DePaolo - Macelwane Award
Thomas H. Jordan - Macelwane Award
Waldo E. Smith - Waldo E. Smith Award

The 1983 Bucher Medal will be presented to John Handin at the Fall Meeting.

Fellows

Peter L. Bender, Geodesy
Herbert S. Bridge, Solar Planetary Relationships
Marx Brook, Atmospheric Sciences
Harmon Craig, Volcanology, Geochemistry & Petrology
Lynn W. Gelhar, Hydrology
G. V. Gibbs, Volcanology, Geochemistry & Petrology
Dennis E. Hayes, Oceanography
Andrew P. Ingersoll, Planetology
Hugh H. Kieffer, Planetology
Michael W. McElhinny, Geomagnetism & Paleomagnetism
John G. Ramsay, Tectonophysics
Frank M. Richter, Tectonophysics
Jacob Rubin, Hydrology
Edward C. Stone, Solar Planetary Relationships
James R. Wallis, Hydrology

Four Fellows who did not receive their certificates in 1982 will also be honored.

Bernard H. Chovitz, Geodesy
James R. Holton, Meteorology
V. Rama Murthy, Volcanology, Geochemistry & Petrology
Klaus Wyrtki, Oceanography

Join in the Festivities

The **Honors Ceremony** will be held in the Francis Scott Key Ballroom of the Baltimore Hilton Hotel at 6:00 P.M. on Wednesday, June 1. All meeting participants are invited and are urged to attend. A **Reception** will follow the ceremony; you can meet and congratulate those being honored and share a glass of wine with them.

The **President's Dinner** in honor of the medalists, awardees, and Fellows will begin at 8:00 P.M. It is a more lavish and formal affair, with black tie optional. Tickets for the dinner are $25 per person. You may order your tickets with your advance registration, purchase them at the meeting, or call AGU toll free at 800-424-2488 (462-6903 in the D.C. area).

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Refer to EOS issues April 12 and 26 for registration information.

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Geochemistry

1410 Chemistry of the atmosphere
CO_2 MEASUREMENTS WITH AN INFRARED-LASERSPECTROMETER ON FLASK SAMPLES COLLECTED AT THE JUNGFRAUJOCH HIGH ALTITUDE RESEARCH STATION (3500 m a.s.l.) AND WITH LIGHT AIRCRAFT UP TO 8000 METERS OVER SWITZERLAND
R. Zumbrunn (Physics Institute, University of Bern, CH-3012 Bern, Sidlerstrasse 5, Switzerland), A. Neftel, H. J. Friedli and D. Rauber

We discuss the use of an infrared laser spectrometer for CO_2 concentration analysis of flask samples. The precision of the system is 2.5 ‰ or 0.75 ppm. A series of monthly measurements at the Jungfraujoch high altitude research station, Switzerland, (3500 m a.s.l.) is discussed together with vertical profiles up to 8000 m a.s.l..

J. Geophys. Res., Green, Paper 3C0282

Meteorology

3715 Chemical composition and chemical interactions
CUMULUS CLOUD TRANSPORT OF TRANSIENT TRACERS
L.T. Gidel (Meteorology and Physical Oceanography, School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, Florida 33149)

A theoretical framework is developed for including cumulus cloud transport, rainout of water soluble gases, and aqueous phase chemistry into gas phase photochemical models. Cloud populations are represented as ensemble distributions of individual clouds of various heights. An individual cloud is represented as a one-dimensional, steady state plume with height independent radius entraining air from the boundary of the cloud. The model is applied to several hypothetical atmospheric tracers to show how clouds may affect the tropospheric distributions of ozone, NO_x, SO_2, PAN, hydrocarbons and other gases. Although the numerical experiments were based on cloud mass fluxes from diagnostic studies in the tropics, and thus are not representative of the entire globe, it was found that an increasing mixing ratio with height in the free troposphere can be produced for some gases with only a surface source when clouds are present. This suggests that some reactive tropospheric species with primarily surface sources may play a somewhat more important role in tropospheric chemistry than is presently believed depending on the global distribution of cloud mass fluxes. Deficiencies in existing photochemical models due to the way clouds are typically treated are discussed.

J. Geophys. Res., Green, Paper 3C0445

3715 Chemical composition and chemical interactions
A TWO DIMENSIONAL PHOTOCHEMICAL MODEL OF THE ATMOSPHERE
I. CHLOROCARBON EMISSIONS AND THEIR EFFECT ON STRATOSPHERIC OZONE
L.T. Gidel (Division of Meteorology and Physical Oceanography, University of Miami, Miami, Florida, 33149), P.J. Crutzen and J. Fishman

A two-dimensional photochemical model is needed to examine changes to the ozone layer due to emissions of $CFCl_3$, CF_2Cl_2, CH_3CCl_3 and CCl_4. The influence of a possible secular increase in tropospheric methane up to 2% per year was found to be small, although it acts to mask decreases in total ozone caused by the chlorocarbons. Increasing NO_x emissions due to industrialization also tends to mask decreases in total ozone, and may have caused total ozone to increase by ~1%. The model calculated ozone decreases are estimated to be about 3% by 1980. This estimate is higher than estimates by similar models, although we note that CCl_4 and CH_3CCl_3 emissions are included in the model in addition to $CFCl_3$ and CF_2Cl_2. This is significant because the model indicates that CCl_4 has dominated the ozone depletions so far, and knowledge of the historical emission rate of CCl_4 to the atmosphere is incomplete. There remain sufficient, significant disagreements between theoretical and observed concentrations and variabilities particularly for odd nitrogen and ClO, to caution against assigning too much confidence in the calculated ozone depletion.

J. Geophys. Res., Green, Paper 3C0444

3715 Chemical composition (Stratospheric ozone)
INTERANNUAL VARIATIONS OF GLOBAL TOTAL OZONE REVEALED FROM NIMBUS 4 BUV AND GROUND-BASED OBSERVATIONS
F. Hasebe (Geophysical Institute, Kyoto University, Kyoto, 606, Japan)

To investigate interannual variations in global distributions of total ozone, an objective analysis is made by the hybrid use of Nimbus 4 BUV and ground-based network data. Much improvement in spatial resolution and reliability of the analysis is attained. From the deduced time changes in seven years (April 1970 – May 1977) the quasi-biennial and four-year oscillations (QBO and FYO) are separated by numerical filtering. Characteristic features of these oscillations are investigated by examining time changes of global patterns as well as some spatial mean values.

The QBO in total ozone is characterized by large variabilities in time and space. Typical features are as follows: In tropics, positive deviations nearly coincide with the westerly phase of equatorial zonal wind at 50 mb. Zonally uniform phase changes exhibiting cross-equatorial northward propagation are observed. Phase propagation is continuous to northern mid-latitudes, where the ozone distributions are accompanied by zonal wavenumber 3-4 disturbances. In northern high latitudes, deviations superposed by wavenumber 1 distribution are found often opposite to mid-latitudes. In the southern hemisphere, the phase is reversed around 15°S and nearly out-of-phase relation to northern mid-latitudes is observed. Wavenumber 1 is the dominant wave component throughout the southern hemisphere.

The FYO in total ozone is suggested as a global phenomenon. This oscillation is characterized as follows: A roughly symmetric distribution with respect to equator is observed with the out-of-phase relation between tropics and extratropics. There also appears a phase propagation starting from southern mid- and high latitudes and reaching northern high latitudes. Zonally uniform phase changes with wavenumber 3 disturbances are seen in the northern mid-latitudes. In the equatorial region and southern hemisphere, systematic phase precedings in the western hemisphere are observed.

For both QBO and FYO, planetary scale total ozone waves of zonal wavenumber 1 in the winter hemisphere are seen to penetrate into the summer hemisphere. (Total ozone, optimum interpolation, quasi-biennial oscillation, four-year oscillation).

J. Geophys. Res., Green, Paper 3C0592

Particles and Fields—Ionosphere

5515 Auroras
SMALL-SCALE AURORAL ARC DEFORMATIONS
John S. Wagner, R. D. Sydora, T. Tajima, T. Hallinan, L. C. Lee and S.-I. Akasofu (Geophysical Institute, University of Alaska, Fairbanks, Alaska, 99701)

An auroral arc undergoes various types of deformations, such as curls, folds and spirals. In this paper, we examine the formation mechanism of folds by a plasma simulation method. We suggest that folds, as well as curls, can arise from electrostatic shear induced instabilities. The differences between the two forms are controlled by the presence of ambient ions which must be present to shield the electric field of the precipitating electron charge sheet. It is shown that curls form when the ion sheath thickness is large in comparison to the electron sheet. Folds form when the ion sheet is thin and lags slightly behind the electron guiding centers, setting up an additional electric field that controls the later stages of instability growth.

J. Geophys. Res., Blue, Paper 3A0533